

## CLAIMS

The invention claimed is:

- 1     1.     A system for migrating an application developed around an ISAM database server to  
2           an SQL database server without source level changes, said system comprising:  
3           a)     a database migration tool; and  
4           b)     a database driver;  
5           wherein said database migration tool migrates data from the ISAM database server to  
6           the SQL database server in such a manner that transparency of data operation is  
7           maintained from a perspective of the application; and  
8           wherein said database driver intercepts functional calls specifying any database  
9           operation made to the ISAM database server from the application and translates them  
10          into corresponding SQL functional calls and statements in such a manner that allows  
11          complete transparency between the SQL database server and the application so as to  
12          allow the application to continue to perform as it normally does and continue to  
13          receive and send data to the SQL database server in a format it expects with the ISAM  
14          database server.
- 1     2.     The system as defined in claim 1, wherein said database migration tool is a standard  
2           32-bit application that runs on a MICROSOFT® WINDOWS™ platform.
- 1     3.     The system as defined in claim 1, wherein said database driver uses a native low level  
2           API to communicate with the SQL database server.

- 1     4.     The system as defined in claim 1, wherein said database driver provides a direct  
2           connection to the SQL database server.
- 1     5.     The system as defined in claim 1, wherein said database migration tool sets up the SQL  
2           database server.
- 1     6.     The system as defined in claim 1, wherein said database migration tool copies data at  
2           high speeds using native tools for fast data loading.
- 1     7.     The system as defined in claim 1, wherein said database migration tool copies data at  
2           high speeds using native high speed data loading mechanisms and application  
3           programming interfaces.
- 1     8.     The system as defined in claim 1, wherein said database migration tool generates SQL  
2           scripts to create tables and indexes.
- 1     9.     The system as defined in claim 1, wherein said database migration tool is a GUI  
2           application that sets up a necessary environment and files that are later used by said  
3           database driver.
- 1     10.    The system as defined in claim 1, wherein said database migration tool translates  
2           database and security information from the ISAM database server to the SQL database  
3           server;  
4           wherein the database information comprises data files or table definitions; and  
5           wherein the database information comprises index information.

1     11.     The system as defined in claim 1, wherein said database migration tool reads table and  
2             index definitions;  
3             wherein said database migration tool performs data type translation by mapping data  
4             types from the ISAM database server to the SQL database server;  
5             wherein said database migration tool reads security information on files to be  
6             translated;  
7             wherein said database migration tool generates migration reports and function call  
8             traces;  
9             wherein said database migration tool allows users to browse data before and after  
10            translation;  
11            wherein said database migration tool allows switching between the ISAM and the SQL  
12            database servers by just adding or removing driver name prefixes;  
13            wherein said database migration tool generates scripts for fast loading of data into  
14            native types by generating text files and scripts that can be used by the SQL database  
15            server for high-speed database migration;  
16            wherein said database migration tool allows migrated tables to be removed or dropped  
17            from the SQL database server;  
18            wherein said database migration tool allows data to be read back into a table of the  
19            ISAM database server from a corresponding migrated table of the SQL database  
20            server; and  
21            wherein said database migration tool generates auxiliary files with appropriate table  
22            information so as to allow said database driver to function properly in its task as  
23            functional translator.

- 1     12.     The system as defined in claim 1, wherein a type of functional translation said database  
2             driver performs is dependent on the ISAM database server and the SQL database  
3             server between which said database driver acts as a middle-ware or bridge.
- 1     13.     The system as defined in claim 1, wherein said database driver has an ability to find  
2             and fetch a first record of a table based on a given index or a default index;  
3             wherein said database driver has an ability to find and fetch a last record of a table  
4             based on a given index or a default index;  
5             wherein said database driver has an ability to find a next record in a table based on a  
6             given index;  
7             wherein said database driver has an ability to find a previous record in a table based  
8             on a given index;  
9             wherein said database driver has an ability to find a record with index values greater  
10            than a current active record based on a given index;  
11            wherein said database driver has an ability to find a record which has index values  
12            greater than or equal to a current active record in a record buffer;  
13            wherein said database driver has an ability to find a record which has index values less  
14            than or equal to a current active record in a record buffer; and  
15            wherein said database driver has an ability to find a record from a table which has  
16            index values exactly the same as a current active record in a record buffer.
- 1     14.     The system as defined in claim 1, wherein said database driver has an ability to find  
2             an existing record, apply changes to the record made by the user via the application  
3             interface so as to form an updated record, and save the updated record back in a table  
4             of the SQL database server.

- 1     15.     The system as defined in claim 1, wherein said database driver has an ability to find  
2             a record and delete the record specified by the application.
- 1     16.     The system as defined in claim 1, wherein said database driver has an ability to save  
2             a newly created record into a table of the SQL database server.
- 1     17.     The system as defined in claim 1, wherein said database driver has an ability to start  
2             a transaction on the SQL database server and provide a same transactional  
3             functionality of the ISAM database server.
- 1     18.     The system as defined in claim 1, wherein said database driver has an ability to send  
2             a transaction instruction to the SQL database server and make the transaction  
3             permanent by committing to disk.
- 1     19.     The system as defined in claim 1, wherein said database driver has an ability to issue  
2             an abort transaction command in an event of an error during a begin/end transaction  
3             block so as to allow the transaction to be rolled back restoring record buffers and tables  
4             to their original states.
- 1     20.     The system as defined in claim 1, wherein said database driver allows structure of an  
2             existing index to be modified by the application.
- 1     21.     The system as defined in claim 1, wherein said database driver allows functionality to  
2             add a new field to an existing table that is supported by the SQL database server.

- 1     22.     The system as defined in claim 1, wherein said database driver supports creation of a  
2             new index on a table.
- 1     23.     The system as defined in claim 1, wherein said database driver supports deletion of a  
2             field from an existing table.
- 1     24.     The system as defined in claim 1, wherein said database driver allows dropping an  
2             existing index from a table.
- 1     25.     The system as defined in claim 1, wherein said database driver provides a mechanism  
2             to implement auto-increment fields that are available in many ISAM databases as well  
3             as SQL databases in such a way that the application sees no difference between the  
4             ISAM database server and the SQL database server even though the SQL database  
5             server handling is different.
- 1     26.     The system as defined in claim 1, wherein said database driver provides support for  
2             case insensitive indexes available in most ISAM databases but likely absent in some  
3             SQL databases; and  
4             wherein said database driver provides support for an index that contains ascending and  
5             descending index segments in order to avoid costly ORDER BY clauses in an SQL  
6             statement.
- 1     27.     The system as defined in claim 1, wherein said database driver provides a mechanism  
2             to switch between record-at-a-time access provided by the ISAM database server and

3 set-based access provided by the SQL database server so as to perform order entry or  
4 order update by using the record-at-a-time access while for reports or batch processes  
5 by using set-based access.

1 28. The system as defined in claim 1, wherein said database driver provides support for all  
2 authentication methods for the SQL database server since the ISAM database server  
3 may or may not provide a secure authentication based security service for accessing  
4 tables while this is a standard requirement in the SQL database server;  
5 wherein said database driver automatically pops a login dialog box if a file is opened  
6 without being logged onto the SQL database server;  
7 wherein said database driver provides support for a login command that can be added  
8 to an application either compiled in or externally to support security services;  
9 wherein the login command creates a connection handle which uniquely identifies a  
10 user connection;  
11 wherein the connection handle is kept in memory in a data structure during execution  
12 of the application; and  
13 wherein a logout command destroys the memory in the data structure and releases the  
14 connection handle.

1 29. The system as defined in claim 1, wherein a file open command opens an auxiliary file  
2 that is needed to create a memory structure about both ISAM and SQL tables since the  
3 ISAM database server has to open a file before it can access a file whereas in the SQL  
4 database server there is no concept of file open;  
5 wherein the auxiliary file contains information about table structure that is not  
6 supported by the SQL database server but is needed by the application;

7 wherein the auxiliary file is stored both as a binary and as a text file; and  
8 wherein said database driver supports a close function by destroying all memory  
9 structure created by the file open command and closes a table handle for a table since  
10 closing a file of the ISAM database server means the handle for the file is released and  
11 the file is no longer used by the application whereas the SQL database server doesn't  
12 require a table to be closed.

1 30. The system as defined in claim 1, wherein said database migration tool performs a  
2 convert database operation by creating a corresponding table in the SQL database  
3 server so as to form a newly created table and copying data of the ISAM database  
4 server to the newly created table.

1 31. The system as defined in claim 30, wherein said database migration tool during said  
2 convert database operation brings up another dialog box to allow the user to set  
3 migration options so as to form selections.

1 32. The system as defined in claim 31, wherein said selections are stored in auxiliary files  
2 called .INT (intermediate) file and .TD (table definition) file.

1 33. The system as defined in claim 1, wherein said database driver supports setting and  
2 fetching table and database attributes when requested by the application.

1 34. The system as defined in claim 33, wherein a table attribute is finding out a total  
2 number of records in a table;



3 wherein said database driver when requested by the application fetches a count of total  
4 number of records in the SQL database server and provides it to the application;  
5 wherein a table attribute is a maximum number of records allowed; and  
6 wherein a table attribute is file mode/read only or not.

1 35. The system as defined in claim 33, wherein a table attribute is changing field names  
2 or field types.

1 36. The system as defined in claim 1, wherein said database driver provides a mechanism  
2 to support additional commands specific to said database driver that result in increased  
3 performance.

1 37. The system as defined in claim 36, wherein the additional commands include  
2 commands that restrict number of columns to be fetched from a table by allowing the  
3 application to switch between complete record and selected fields fetch mechanism by  
4 virtue of ISAM databases typically fetching a complete record at a time while most  
5 applications written for SQL databases fetch only needed columns or fields from  
6 tables.

1 38. The system as defined in claim 1, wherein said database migration tool identifies any  
2 repository containing information regarding an ISAM database structure to migrate;  
3 wherein said database migration tool allows a user to choose which data files of the  
4 ISAM database server will be migrated; and  
5 wherein said database migration tool initiates migration.

- 1     39.     The system as defined in claim 38, wherein the repository containing information  
2            regarding an ISAM database structure includes data dictionaries, file definitions, or file  
3            lists.
- 1     40.     The system as defined in claim 38, wherein the ISAM database structure includes  
2            tables, indexes, sequences definitions, and any other information defining an ISAM  
3            database structure.
- 1     41.     The system as defined in claim 1, wherein said database migration tool allows a user  
2            to locate and select a repository containing information regarding an ISAM database  
3            structure and display file entries in a file list dialog box by virtue of said database  
4            migration tool working with the repository containing information regarding an ISAM  
5            database structure
- 1     42.     The system as defined in claim 41, wherein the repository containing information  
2            regarding an ISAM database structure includes data dictionaries, file definitions, or file  
3            lists.
- 1     43.     The system as defined in claim 41, wherein the ISAM database structure includes  
2            tables, indexes, sequences definitions, and any other information defining an ISAM  
3            database structure.
- 1     44.     The system as defined in claim 1, wherein said database migration tool adds a driver  
2            prefix to a file to identify that the file has already been migrated to the SQL database  
3            server.

1     45.     The system as defined in claim 44, wherein said prefix is a name of the driver dll.

1     46.     A method for migrating an application developed around an ISAM database server to  
2             an SQL database server without source level changes, said method comprising the  
3             steps of:

4             a)     setting up by a database migration tool the SQL database server and migrating  
5                     by the database driver data from the ISAM database server to the SQL database  
6                     server in such a manner that transparency of data operation is maintained from  
7                     a perspective of the application; and

8             b)     intercepting by a database driver functional calls specifying any database  
9                     operation made to the ISAM database server from the application and  
10                    translating them by the database driver into corresponding SQL functional calls  
11                    and statements in such a manner that allows complete transparency between  
12                    the SQL database server and the application so as to allow the application to  
13                    continue to perform as it normally does and continue to receive and send data  
14                    to the SQL database server in a format it expects with the ISAM database  
15                    server.

1     47.     The method as defined in claim 46, wherein said setting up step includes the steps of:

2             a)     identifying any repository containing information regarding an ISAM database  
3                     structure to migrate;

4             b)     choosing which data files will be migrated; and

5             c)     initiating a migration process.

- 1     48.     The method as defined in claim 47, wherein the ISAM database structure includes  
2           tables, indexes, sequences definitions, and any other information defining an ISAM  
3           database structure.
- 1     49.     The method as defined in claim 47, wherein the repository containing information  
2           regarding an ISAM database structure includes data dictionaries, file definitions, or file  
3           lists.
- 1     50.     The method as defined in claim 47, wherein said identifying and choosing steps  
2           include the steps of:  
3           a)     allowing a user to locate and select the repository containing information  
4                  regarding an ISAM database structure entry in a file list dialog box by virtue  
5                  of the database migration tool working with the repository containing  
6                  information regarding an ISAM database structure; and  
7           b)     selecting by the user any number of files to migrate by highlighting file names.
- 1     51.     The method as defined in claim 50, wherein said selecting step includes selecting by  
2           a user any number of files to migrate by highlighting file names in the file list dialog  
3           box.
- 1     52.     The method as defined in claim 47, wherein said initiating step includes the step of  
2           performing a convert database operation; and  
3           wherein said performing step includes the steps of:  
4           a)     creating a corresponding table in the SQL database server so as to form a  
5                  newly created table; and

6           b)       copying data of a specific file of the ISAM database server to the newly created  
7                   table.

1    53.    The method as defined in claim 52, wherein said creating step includes the step of  
2           generating by the database migration tool SQL scripts to create tables and indexes.

1    54.    The method as defined in claim 52, wherein said performing step further includes the  
2           step of replacing manually or automatically dynamic link libraries or shared object  
3           libraries which contain functions to handle ISAM database operations with a dynamic  
4           link library or shared object of a same name and a same functional interface capable  
5           of translating ISAM database operation calls to SQL database calls.

1    55.    The method as defined in claim 52, wherein said performing step further includes the  
2           step of bringing up another dialog box; and  
3           wherein said bringing up step includes the step of allowing the user to set migration  
4           options so as to form selections.

1    56.    The method as defined in claim 52, wherein said copying step includes the step of  
2           copying data by the database migration tool at high speeds using native tools for fast  
3           data loading.

1    57.    The method as defined in claim 56, wherein said copying step includes copying data  
2           by the database migration tool at high speeds using native high speed data loading  
3           mechanisms and application programming interfaces.

1     58.     The method as defined in claim 55, wherein said selections are stored in auxiliary files  
2             called .INT (intermediate) file and .TD (table definition) file.

1     59.     The method as defined in claim 55, wherein said performing step further includes the  
2             step of adding by the database migration tool a driver prefix to a file to identify that the  
3             file has already been migrated to the SQL database server.